REMARKS

The Office Action has imposed a restriction requirement under 35 U.S.C. § 121 as follows:

I. Claims 67, 75-84, 97-102, 108-114, classified in class 423, subclass 447.2;

II. Claims 70, 73, 74, drawn to mixture, classified in class 252, subclass 500; and

III. Claims 103-107, drawn to a device, classified in class 313, subclass 1+

In support of the restriction requirement, the Office Action alleges that Groups I, II and III are related as sub-combinations disclosed as useable together in a single combination. The Office Action alleges that the subcombinations are distinct if they do not overlap in scope, and are not obvious variants, and if it can be shown that one subcombination is separately useable. The Office Action alleges that the subcombination of Group I has a separate utility, such as an electron emitter. The Office Action requires that applicants elect one group for continued examination.

In response to the restriction requirement, applicants elect Group I, Claims 67, 75-84, 97-102 and 108-114 for continued examination herein.

However, applicants hereby traverse the Examiner's requirement for restriction and request reconsideration in view of the following Remarks.

Applicants respectfully request that this Restriction Requirement be withdrawn since it is not in compliance with 35 U.S.C. §121 and 37 C.F.R. §§1.141-1.142. 35 U.S.C. §121 provides that the Commissioner may restrict an application when "two or more independent and distinct inventions are claimed in a single application." (Emphasis added). Similarly, 37 C.F.R. § 141(a) permits restriction conditioned upon a finding that independent and distinct inventions

are found within one application. Only the statutory requirement that the various groups of claims are distinct has been proffered as the basis for the requirement of restriction. Even assuming, pro arguendo, that the Official Action was correct with respect to distinctiveness, there is absolutely no indication in the Official Action that Groups I, II and III are also independent.

In fact, applicant submits that Groups I, II and III are not independent.

MPEP §802.01 defines independent as follows:

> The term "independent" (i.e., not dependent) means that there is no disclosed relationship between the two or more subjects disclosed, that is, they are unconnectedin design, operation or effect.

Group I relates to a solid substance comprised by more than one half weight of hollow carbon nanotubes having walls consisting essentially of two layers of carbon atoms, i.e., DWNT's, wherein said nanotubes consist of two concentric nearly cylindrical graphene layers, while Group II relates to an electron emissive material comprising a surface consisting primarily of emissive tubules, wherein the electron emissive material is composed of a mixture of double walled nanotubes and nanotubes other than double walled nanotubes which have less than 5 walls, while Group III relates to a field emission device comprising a cathode having an electron-emissive material, the electron emissive material having a surface consisting of a plurality of nanotubes with a controlled number of graphene layers uniformly distributed over the cathode surface wherein each of the plurality of emissive elements is generally a double walled nanotube and an anode disposed to receive electrons emitted form the electron-emissive cathode.

Thus, all three groups are related, as they are relate to the subject matter of double walled nanotube.

Thus, because these groups of claims are interdependent, and therefore not independent, the claims which the Office Action has grouped separately are not "independent

and distinct" so as to justify the Restriction Requirement. It is therefore respectfully submitted that the Restriction Requirement is improper and cannot be maintained.

The Office Action also seems to suggest that a prior art search requiring search in more than one classification is sufficient criteria for maintaining a restriction to allegedly different patentable inventions. This of course is in error.

Reliance on the classification of the groups of claims does not establish that the subject matter in the various group are independent and distinct. The classification system has no statutory recognition as evidence of whether inventions are independent or distinct. The classification system is instead an aid in finding and searching for patents.

The classification system is also an unreliable basis for requiring restriction between claims to the various aspects of applicant's unitary invention, because the classification system exhibits considerable overlap in technical definitions. In particular, the definitions of subclasses in the classification system do not prevent an Examiner from basing patentability decisions, as to claims he assigned to one group, on patent references found in the subclass(es) with which he associated another group of claims.

Furthermore, the classification system is a poor basis for requiring restriction between related aspects of an invention because classifications and definitions change over time. Thus, a classification that might have seemed to support restriction at a given time could change, thereby casting a shadow over the propriety of the restriction requirement later on during the term of the patents issuing from parent and divisional applications. Indeed, classifications seem largely to change in response to considerations of administrative convenience, and often in response to nothing more than growth in the number of patents in a given class or subclass. These considerations have nothing to do with whether the subject matter of patents assigned to

different classifications is "independent and distinct", as those terms are used in 35 U.S.C. §121, which fact proves that basing restriction requirements on the classification system is improper.

It is vital to all applicants that restriction requirements issue only with the proper statutory authorization, because patents issuing on divisional applications, which are filed to prosecute claims that the Examiner held to be independent and distinct, can be vulnerable to legal challenges alleging double patenting. The third sentence of 35 U.S.C. §121, which states that a patent issuing on a parent application "shall not be used as a reference" against a divisional application or a patent issued thereon, does not provide comfort to applicants against such allegations. The Court of Appeals for the Federal Circuit has declined to hold that 35 U.S.C. §121 protects a patentee from an allegation of same-invention double patenting, Studiengesellschaft Kohle mbH v. Northern Petrochemical Co., 784 F.2d 351, 355, 228 U.S.P.Q. 837, 840 (Fed. Cir. 1986); and in Gerber Garment Technology Inc. v. Lectra Systems Inc., 916 F.2d 683, 16 U.S.P.Q. 2d 1436 (Fed. Cir. 1990), that court held that §121 does not insulate a patentee from an allegation of "obviousness-type" double patenting, and in fact affirmed the invalidation on double patenting grounds of a patent that had issued from a divisional application filed following a restriction requirement. Furthermore, it is far from clear that the step of filing a terminal disclaimer is available to resolve a double patenting issue that arises after the issuance of a patent on the divisional application.

All these considerations indicate that the imposition of a restriction requirement with inadequate authority can lead to situations in which an applicants legitimate patent rights are exposed to uncertainty and even extinguished. Accordingly, to protect a patentee's rights and to serve the public's interest in the legitimacy of issued patents, applicants respectfully urge the

Examiner not to require restriction in cases such as the present application wherein various aspects of a unitary invention are claimed.

In addition, the Courts have recognized the advantages to the public interest to permit patentees to claim all aspects of their invention, as the applicants have done herein, so as to encourage the patentees to make a more detailed disclosure of all aspects of their invention. The CCPA has observed:

> We believe that the constitutional purpose of the patent system is promoted by encouraging applicants to claim, and therefore to describe in the manner required by 35 U.S.C. §112 all aspects of what they regard as their invention, regardless of the number of statutory classes involved. (Emphasis added).

In re Kuehl, 456, F.2d 658, 666, 177 USPQ 250, (CCPA 1973).

Furthermore, applicants respectfully request that in view of increased Official Fees and the potential limitation of applicants' financial resources, a practice which arbitrarily imposes a Restriction Requirement may become prohibitive, and thereby contravenes the constitutional intent to promote and encourage the progress of science and the useful arts.

Hence, it is respectfully requested that the Examiner reconsider and withdraw the Restriction Requirement, and provide an action on the merits with respect to all of the claims.

Claims 75, 78, 82 and 97 have been amended to recite that emissive tubles are nanotubes having two concentric nearly cylindrical graphene layers. Support is found in original claim 67.

No new matter is added to the application.

Pursuant to the rejection of Claims 67, 75-84, 97-102, 108-114 under 35 U.S.C. § 103, the Office Action cites an article by Flahaut et al. in Journal of Materials Chem, 2000, 10, 249-252 ("Flahaut et al.")

Flahaut et al. are directed to a carbon nanotube - Co - Mg O composite powder. According to Flahaut et al., more than 80% of the carbon nanotubes have either one or two walls.

The rejected claims are directed to, *inter alia*, a solid substance comprised by more than one half by weight of hollow carbon nanotubes having walls consisting essentially of two layers of carbon atoms, said nanotubes consisting of two concentric nearly cylindrical graphene layers. In another embodiment, the rejected claims are directed to, *inter alia*, an electron emissive material comprising a surface consisting primarily of a plurality of emissive tubules, wherein each of the plurality of emissive tubules are nanotubes having two concentric nearly cylindrical graphene layers, wherein each of cylindrical layers of the nanotubes have a lattice spacing of 0.35 – 0.45 nm. In another embodiment, the present invention is directed to, *inter alia*, an electron emissive material comprising a surface consisting primarily of a plurality of emissive tubules, wherein each of the plurality of emissive tubules is generally double walled nanotubes consisting of two concentric nearly cylindrical graphene layers, wherein end cap of the double walled nanotubes with double layer curvature generates greater electric field strength than a single curvature, graphitic sheet, edge or ridge emitter. In still a further embodiment, the rejected claims are directed to, *inter alia*, an electron emissive material comprising a surface consisting primarily of a plurality of emissive tubules, wherein each of the plurality of emissive tubules is generally double walled nanotubes having two concentric nearly cylindrical graphene layers, wherein the double walled nanotubes have a diameter greater than 1.2 nm. In a further embodiment, the rejected claims are directed, *inter alia*, to an electron emissive material

comprising a surface consisting primarily of a plurality of emissive tubules, wherein each of the plurality of emissive tubules is generally double walled nanotubes having two concentric nearly cylindrical graphene layers wherein the double walled nanotubes emit an electron at an average electric field of less than 10 V/μm. In another embodiment, the rejected claims are directed to, *inter alia*, an electron emissive material comprising a surface consisting primarily of a plurality of emissive tubules, wherein each of the plurality of emissive tubules is generally nanotubes having two concentric nearly cylindrical graphene layers. A further embodiment of the rejected claims is directed to, *inter alia*, substantially pure double-wall nanotubes, whereas the double-wall nanotubes have two concentric nearly cylindrical graphene layers.

It is noted that Flahaut et al. do not teach, disclose or suggest electron emissive material comprised of nanotubes therein. Thus, the subject matter of Claims 75-84 and 97-102 is not described or suggested therein.

But, more importantly, the Flahaut et al. article is not a reference. Enclosed herewith is a copy of Flahaut et al., which indicates the date of publication thereof as January 27, 2000. Enclosed herewith is an executed Declaration by one of the inventors Dr. Moravsky in which the declarant testifies that he conceived and reduced to practice the double walled nanotubes of the present invention prior to January 27, 2000.

Thus, applicants have antedated Flahaut et al.; withdrawal of this rejection under 35 U.S.C. § 103(a) is respectfully requested.

Pursuant to the rejection of Claims 67, 75-84, 97-102, 108, 110, 111 and 114 under 35 U.S.C. § 102(e), the Office Action cites WO 00/17102 of which Smalley et al. are inventors ("Smalley et al."), with United States Patent No. 6,692,717 being taken "as a translation thereof".

Smalley et al. relate to single walled carbon nanotubes and the catalyst substrate system promoting the growth of single walled nanotubes. The Office Action refers to Column 12, Lines 20-25 of United States Patent No. 6,692,717, which is the corresponding U.S. Patent of Smalley et al. in which it alleges that they teach a composition of 70% DWNTs.

The present invention is directed to, *inter alia*, double walled nanotubes and the emissive material comprised of same, having two concentric nearly cylindrical graphene layers. Accordingly, they do not contain any kinks along their length as evidenced by the multiple electron micrographs in the present application.

However, any double walled nanotubes found in Smalley et al. cannot be specified as consisting of two nearly cylindrical graphene layers, as they contain multiple kinks along their length. This is seen in the Figures of Smalley et al., of which a better copy thereof seen in the article in Chemical Physics Letters 1998, 195-202, upon which Smalley et al. are based. Attention is directed to especially Fig 4 of the Smalley et al. article where the nanotubes are readily seen with kinks. The kinks are caused only by defects in the crystalline lattice of the tube walls and are reliable means to visually distinguish between defectless and defective tube. The presence of kinks lowers the quality of the tube microstructure, which causes a dramatic deterioration of the nanotube electrical, thermal and mechanical properties, thus drastically restricting their utility. Graphene structure is defined as including only hexagons of carbon atoms. The defects referred to above usually are represented by pentagons, heptagons and octagons of carbon atoms, and by single- and double-carbon atom vacancies that do not meet this definition. Defects, for example pentagons and heptagons in the hexagonal carbon network of the tube wall, cause sudden changes of a tube axis direction, roughness and waviness of tube walls, kinks, corrugations and blow-ups on the tube, and other deviations from the cylindrical

structure pertaining to defectless tubes of the instant invention. These features are abundant in TEM images of Smalley et al. and absent in images of the instant application. Defects drastically deteriorate the properties of carbon nanotubes and make them of much lower utility. Thus the DWNTs of instant application are of much higher quality and utility.

Without wishing to be bound, it is believed that the reason that Smalley et al. have kinks in their nanotubes is that higher temperatures are used in production of DWNTs in the instant application. Higher synthesis temperature facilitates annealing of defects.

At low temperatures used by Smalley et al., the tubes grow much slower than at high temperatures of the instant application. Thus the tube growth rate and accordingly the efficiency of tube production are directly related to tube quality. Less efficient production yields tubes of lower quality. Production of DWNTs in Smalley et al. is of very low efficiency: less than 1 mg of DWNTs per hour is obtained on laboratory scale installation used in Smalley et al., which is thousands times lower than efficiency of DWNT production in the instant application also utilizing laboratory scale installations. Accordingly, the quality of DWNTs in the instant application is much higher.

The main feature of the instant invention is "to efficiently and selectively produce a large quantity of DWNTs as major component". According to the above considerations, "efficiently produce" means produce high quality DWNTs. Therefore, the instant application does not depend on composition of matter of DWNTs produced in Smalley et al., or produced in any other synthesis performed at low temperatures. The term "efficiently produce" used in the present application implies the production of DWNTs at sufficiently high temperatures to obtain DWNTs of correspondingly high quality.

In view of the difference in structure between the nanotubes of the present invention and of Smalley et al., the subject matter of Claims 67, 75-84, 97, 102, 108, 110, 111, 114 is not anticipated by the teachings of Smalley et al. Withdrawal thereof is respectfully requested.

Pursuant to the rejection of Claims 67, 75-84, 97-102, 108-114 under 35 U.S.C. § 103, the Office Action cites Smalley et al.

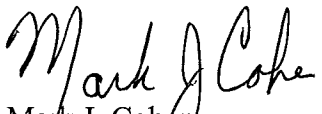
As described hereinabove, any double-walled nanotubes prepared by Smalley et al. have kinks. Applicants reiterate the comments hereinabove, the contents of which are incorporated by reference. Inasmuch as the double walled nanotubes prepared by Smalley et al. have kinks, they do not teach, disclose or suggest the double walled nanotubes of the present invention consisting of two concentric nearly cylindrical graphene layers or to the electrical emissive material comprised thereof for the reasons described hereinabove. Further, as described hereinabove, the more defective nanotubes, such as the ones prepared in Smalley et al., create a dramatic deterioration of the nanotube electrical, thermal and mechanical properties, as compared to the electrical emissive material composed of the nanotubes of the present invention. Thus, for these reasons, Smalley et al. do not teach, disclose or suggest the present invention.

Further, the subject matter of Claim 113 is patentable over Smalley et al. for still another reason. The ratio DWNT:SWNT=30:1 achieved in the instant invention surpasses the maximum value ~2:1 reported in Smalley et al. The extremely high selectivity of DNWT production claimed is an important advantage, as it greatly increases the utility of DWNTs in various applications, for example, in field emission cathodes.

Thus, for the reasons provided, the present invention is patentable over Smalley et al. Withdrawal of the '103 rejection is respectfully requested.

Thus, in view of the Declaration, the Amendment to the Claims and the Remarks hereinabove, it is respectfully submitted that the present case is in condition for allowance, which action is earnestly solicited.

Respectfully Submitted,



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Encls. (Declaration; Hafner et al. article; Flahaut et al. article)